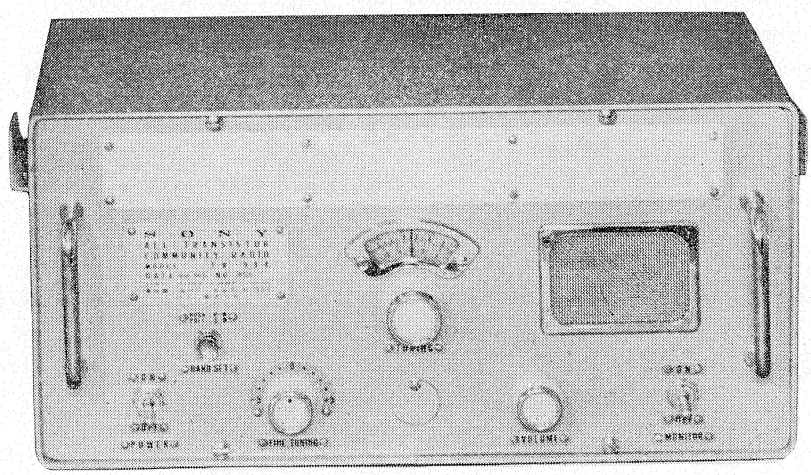
SONY SERVICING GUIDE

TR-903



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Specifications for TR-903

Circuit : 9 transistor Superheterodyne
(including 1 transistor for microphone amplifier)

Covering frequency : MW 535~1605 kc SW 3.9~12 Mc

IF frequency : 455 kc

Sensitivity : 100 μV/m for 1 Watt output

S/N ratio : Better than 20 dB at field intensity of 100 μV/m

Selectivity : Better than 20 dB at 10 kc off

Undistorted output power : 1.5 Watts

Maximum output power : 3 Watts

Output load : 4 Ω

Input impedance : 10 kΩ for Microphone jack and Phone jack

Frequency response : 300~3,000 cps within 6 dB

Self-contained battery : 12 size "D" flashlight batteries divided into 3 groups B1, B2 and B3

Group B1 4 batteries for radio tuner and voltage amplifier (6 Volts)

Group B2 & B3 Each 4 batteries for power amplifier stage (6 Volts)

External battery : 6 Volt storage battery of more than 18 AH can be used
It saves battery life of group B2 and B3.

Current drain : B1 50 mA
B2 & B3 30 mA without signal
650 mA at 1.5 Watt output
950 mA at 3 Watt output

Battery life : B1 more than 100 hours
B2 & B3 〃 〃 15 hours

Minimum operative battery voltage : 4.5 Volts

Dimensions : 7.5″H × 15.5″W × 8.5″D (190 mm × 394 mm × 215 mm)

Weight : Approx. 23 lbs. including batteries (5.8 kgs)

Microphone : Sony F-7 dynamic microphone

Impedance	10 kΩ
Frequency response	60~10,000 cps within 10 dB
Sensitivity	−60 dB/1 μbar (0 dB: 1 Volt)

Horn speaker : Two 12″ re-entrant horns with compression type driver units

Maximum input	10 Watts
Moving coil impedance	8 Ω
Diaphragm	Phenolic

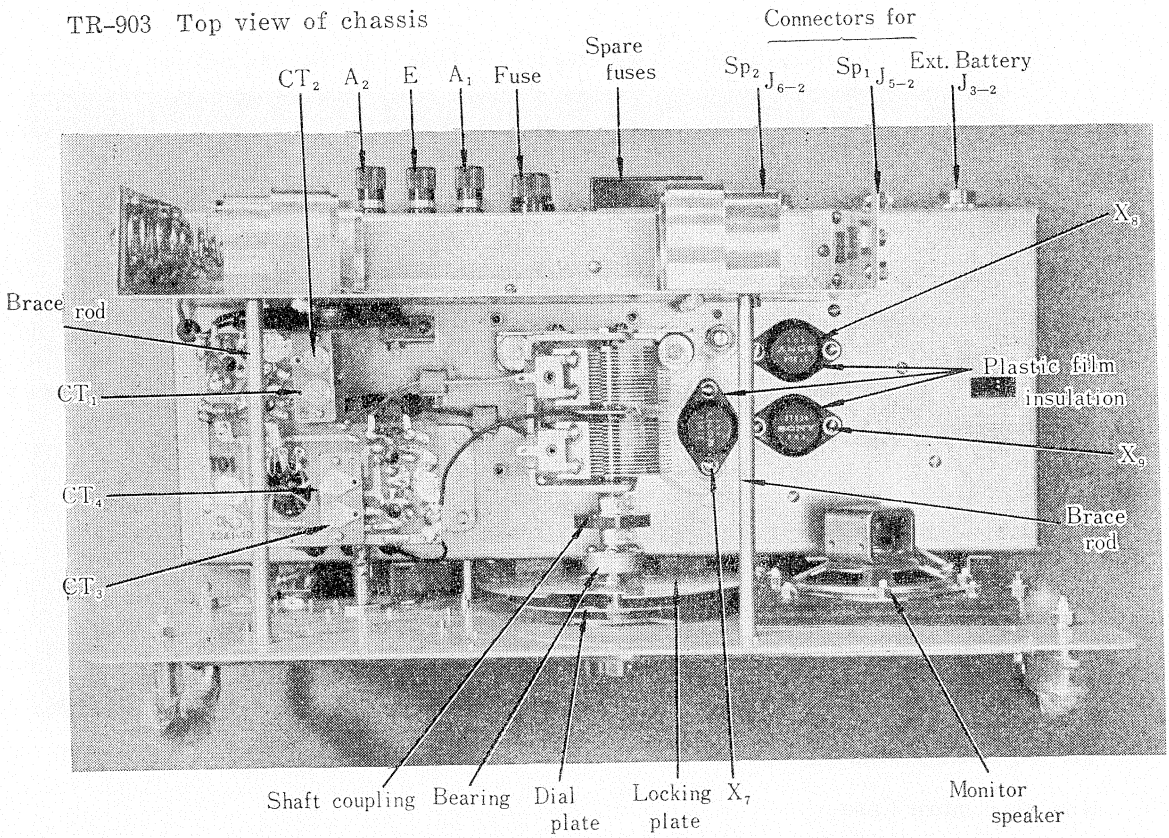
Attached cord : 66′ rubber jacket cable

External battery cord : 6′ rubber jacket cable

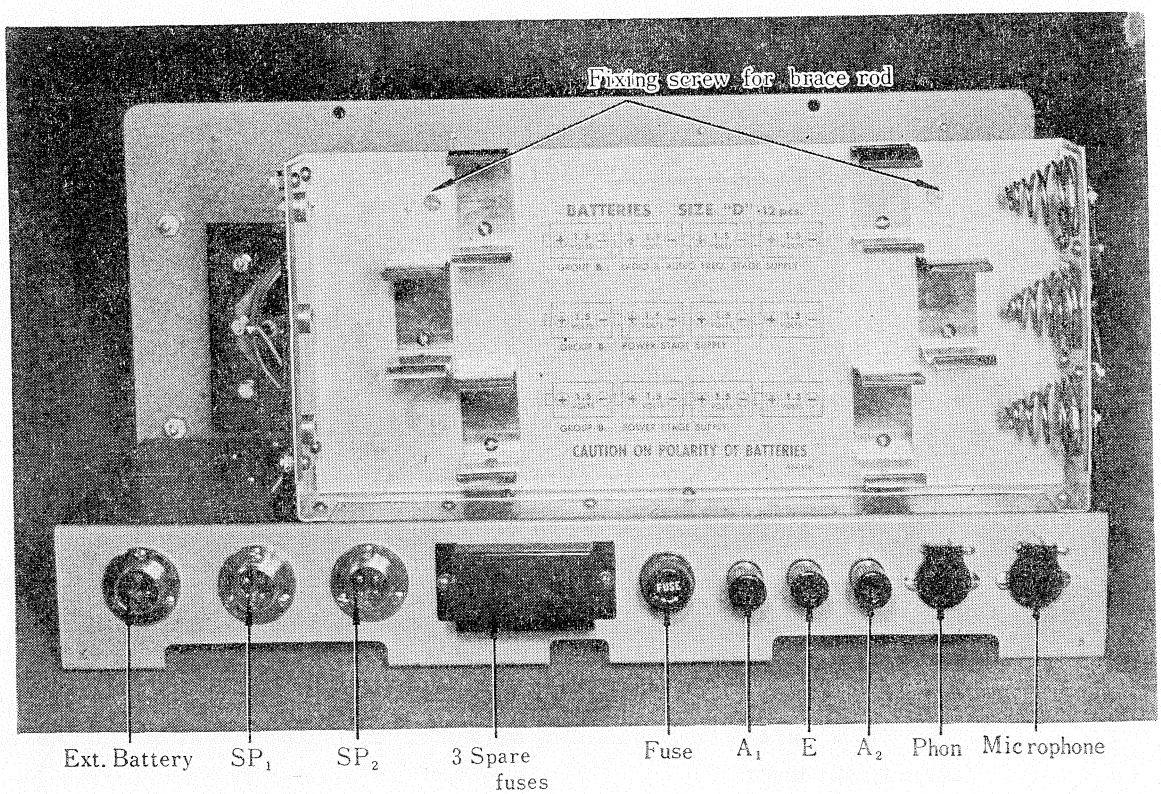
Antenna : All wave doublet antenna and 100′ 300 Ω feeder wire
(available as optional accessory)

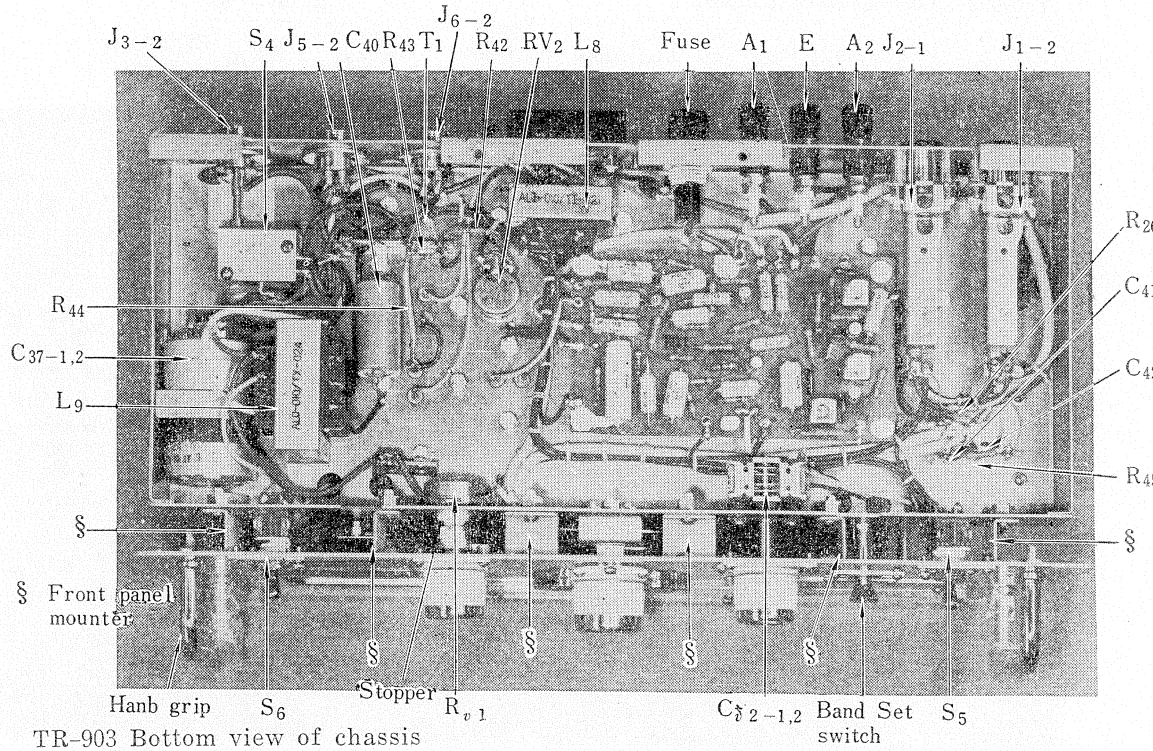
Permissive temperature of this set during operation is 40°C (104°F)

TR-903 Top view of chassis



TR-903 Back side view of chassis





TR-903 Bottom view of chassis

How to remove Case

(a) Take out batteries.
(b) Loosen 2 screws on the bottom and remove them.
(c) Place the set back side down.
(d) Loosen 4 fixing screws on the Front panel.
(e) Lift the chassis gently by holding Hand grips.

How to take off components for replacement

(1) Tuning condenser $CV_{1\text{-}1,2}$
  (a) Unsolder 3 wires.
  (b) Loosen 2 set screws (condenser side) on the shaft coupling.
  (c) Loosen 2 mounting screws. The condenser will be dismounted together with Mounting angle.
  Required tools: Soldering iron, 3 mm screw driver

(2) Volume control RV_1
  (a) Unsolder 3 wires.
  (b) Take off the knob by loosening set screw.
  (c) Loosen 2 set screws for stopper.
  (d) The Volume control can be dismounted by loosening nut.
  Required tools: Soldering iron, screw driver of 2 mm or 3 mm, 6 mm wrench

(3) Fine tuning condenser $CV_{2\text{-}1,2}$
  (a) Unsolder 3 wires.
  (b) Take off the knobs for the Tuning condenser, the Volume control and the Fine tuning condenser.

(c) Remove Band switch button by taking off 2 securing screws.
(d) Loosen and take off nuts for Power switch and for Monitor switch.
(e) Loosen and take off 2 fixing screws for Brace rod on the wall plate of Battery compartment.
(f) Loosen and take off 10 securing nuts for Front panel mounters (6 pieces). By doing this the Front panel will be separated from the chassis.
(g) Loosen and take off 3 fixing screws. The Fine tuning condenser will be dismounted.
Required tools: Soldering iron, 2 mm screw driver, 4 mm wrench, 6 mm wrench

(4) Micro-switch S_4
(a) Unsolder 4 wires from the switch and 2 wires from External battery connector $J_{3\text{-}2}$.
(b) Loosen 3 fixing screws for External battery connector $J_{3\text{-}2}$. The Micro switch will be dismounted together with mounting bracket. Be careful not to lose spring and push rod.
Required tools: Soldering iron, 3 mm screw driver

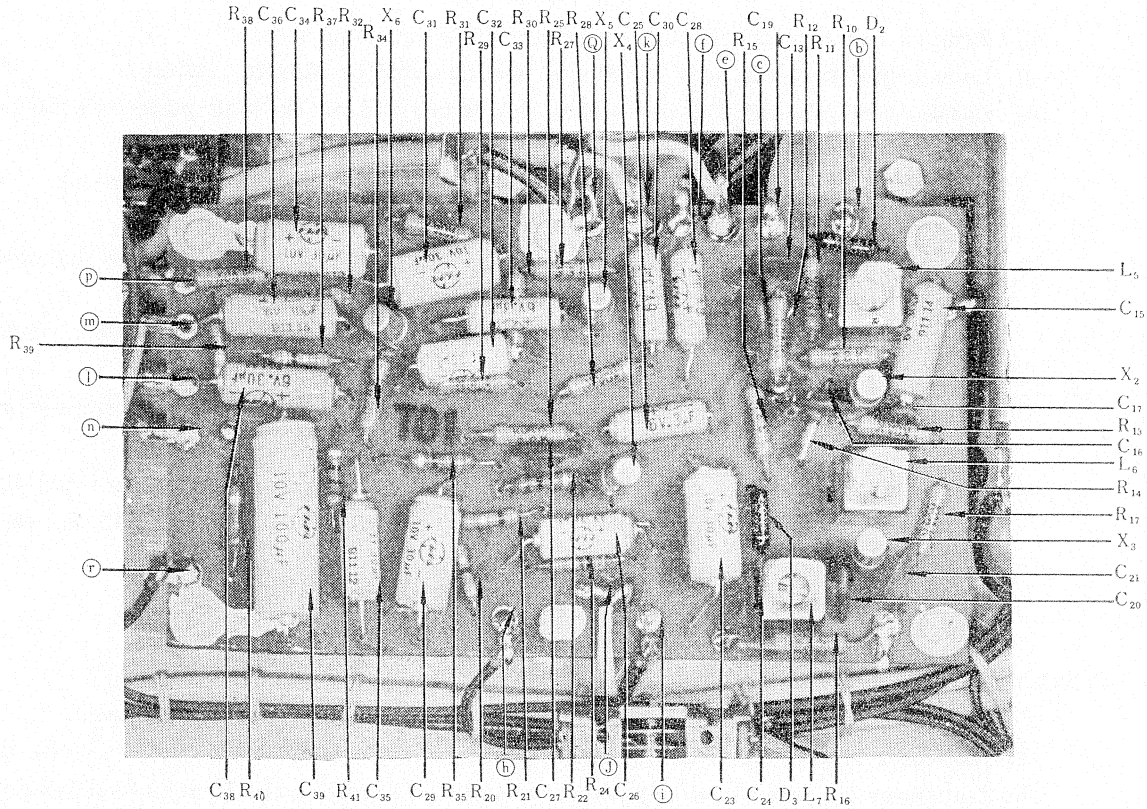
Power transistor 2T303 and 2T304 (used in driver and power amplifier stages)

The construction of the power transistor differs from that of ordinary one.
The collector side of its element makes Ohmic contact with "Header" (or Shell) of the transistor in order to dissipate heat easily. Therefore, the Header itself works as a collector lead; the current is fed through one of 2 fixing screws.
This construction permits the heat to be conducted to metal chassis to which the transistor is mounted. Thus the heat is dissipated through larger surface of metal chassis.
In actual use, a thin plastic film is inserted between the transistor and the chassis for electrical insulation. 2 fixing screws are also insulated by bushings.
Be careful not to throw away the insulating materials when 2T303 or 2T304 is to be replaced.
After mounting new one, confirm the insulation between the transistor shell and the chassis.

Alignment procedures

(1) Required instruments
(a) Signal generator
(b) AC voltmeter with full scale of approx. 5 Volts (used as an output meter)
(c) Multi-meter
(d) Tools

(2) Preparation
(a) Remove the case of the set.
(b) Connect one horn speaker to the set.
(c) Connect AC voltmeter (1. a) across secondary winding of output transformer L_9 (terminal 7 and chassis).
(d) Set Monitor switch at "ON"
(e) Set Fine tuning condenser at "O"



TR-903 Printed circuit board Mounted side (IF, AF Section)

(3) IF alignment

(a) Connect signal generator to X_1-base through 0.1 μF capacitor. The ground side terminal of the signal generator must be connected to terminal E_1 of the set.

(b) Set the Band switch of the set at "MW."

(c) Turn on the Power switch of the set.

(d) Detune the set from every station.

(e) Adjust the signal generator to deliver 455 kc. The signal level must be kept low enough to prevent starting of AGC action.

(f) Adjust core of IFTs L_5, L_6 and L_7 to obtain maximum output.

(4) MW tracking adjustment

(a) Change the signal wire from X_1-base to Antenna terminal A_1. In this case 0.1 μF capacitor must be replaced with 680 Ω resistor.

(b) Set the Tuning condenser at minimum and adjust the signal generator to deliver 1650 kc.

Adjust Trimmer condenser CT_3 to obtain maximum output.

(c) Set the Tuning condenser at maximum position and adjust the signal generator to deliver 520 kc.

Adjust core of Oscillator coil L_3 to obtain maximum output.

(d) Repeat processes (b) and (c) 2 or 3 times until correct adjustment is achieved.

(e) Adjust the signal generator to deliver 1400 kc and turn the Tuning knob of the set to receive the signal.

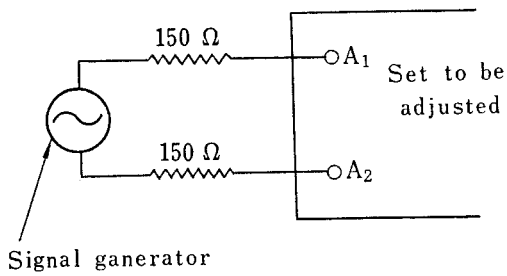
Adjust Trimmer condenser CT_1 to obtain maximum output.

(f) Adjust the signal generator to deliver 620 Kc and turn the Tuning knob to receive the signal. Adjust core of Tuning coil L_1 to obtain maximum output.

(g) Repeat the processes (e) and (f) 2 or 3 times until satisfactory result is achieved.

(5) SW tracking adjustment

(a) Change the connection between the set and the signal generator as follows. Connection to the chassis of the set is not required.



(b) Set the Band switch at SW.

(c) Set the Tuning condenser at minimum and adjust the signal generator to deliver 12.5 Mc.
Adjust Trimmer condenser CT_4 to obtain maximum output.

(d) Set the Tuning condenser at maximum and adjust the signal generator to deliver 3.85 Mc.
Adjust core of Oscillator coil L_4 to obtain maximum output.

(e) Repeat the processes (c) and (d) until satisfactory result is achieved.

(f) Adjust the signal generator to deliver 10.5 Mc and turn the Tuning condenser to receive the signal.
Adjust Trimmer condenser CT_2 to obtain maximum output.

(g) Adjust the signal generator to deliver 5 Mc and turn the Tuning condenser to receive the signal.
Adjust core of Tuning coil L_2 to obtain maximum output.

(h) Repeat the processes (f) and (g) until satisfactory result is achieved.

Cautions:

(a) Signal level must be kept low enough to prevent starting of AGC action.

(b) Adjustment must be performed carefully not to be confused by image frequency.

(c) Volume control must be set at maximum during adjustment.

Voltage and Current distributions

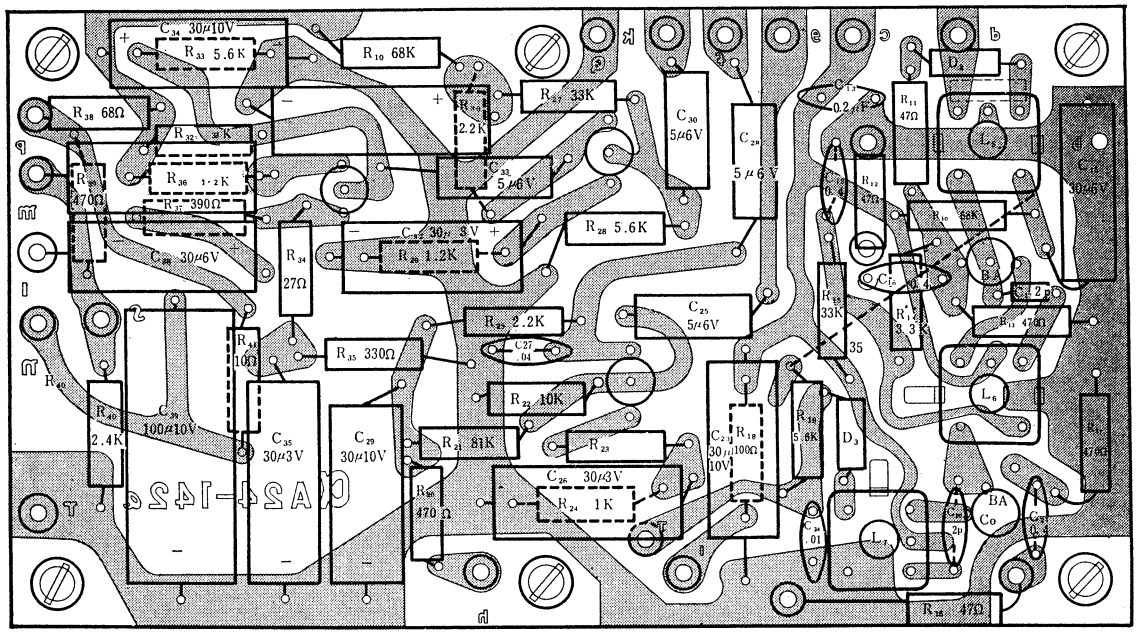
Voltage between the transistor and the negative pole of the battery in Volt

	X_1	X_2	X_3	X_4*	X_5	X_6	X_7	$X_{8,9}$
C	0	5.7	5.7	5.0	4.6	4.0	0	0
B	5.4	0.4	0.6	0.7	0.9	0.7	5.3	5.8
E	5.5	0.3	0.4	0.5	0.7	0.6	5.5	6.0

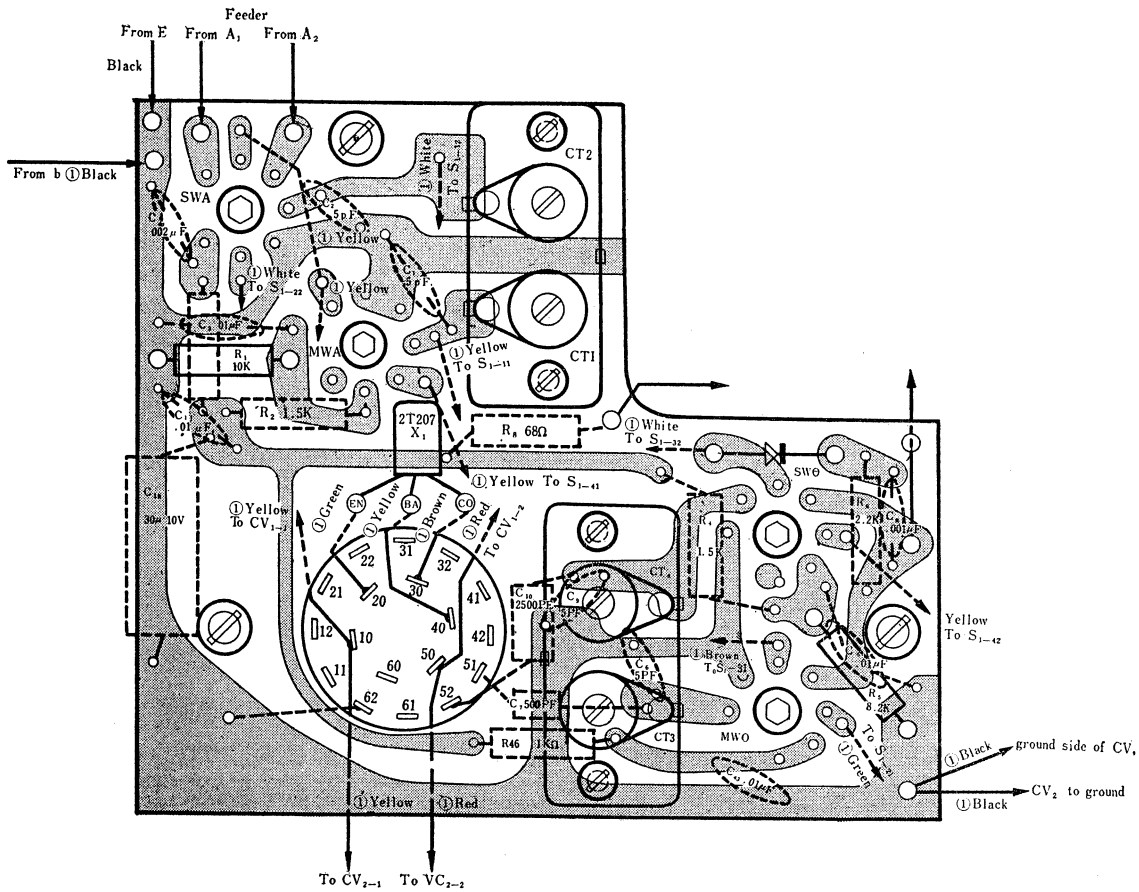
* With the Microphone plug inserted to the Microphone jack

Battery current at 0 signal: Group B_1 Approx. 55 mA when the Radio section is "ON"
Group B_2 & B_3 Approx. 40 mA

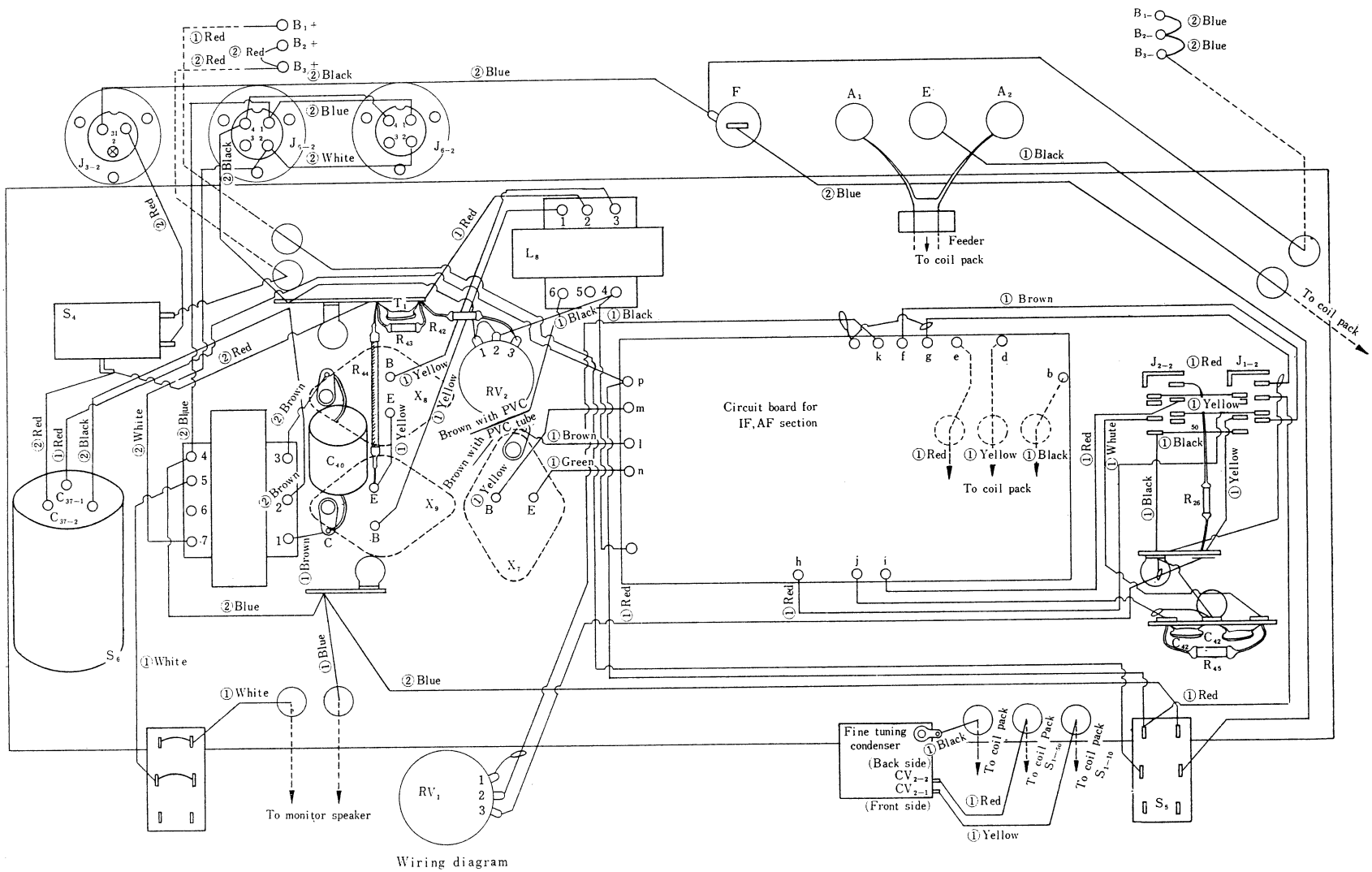
Local oscillator voltage : MW 0.05 V~0.15 V across terminals 5 & 6 on L_3 (by VTVM)
SW 0.05 V~0.15 V across terminals 5 & 6 on L_4 (by VTVM)



TR-903 Mounting diagram of IF and AF section



TR-903 Mounting diagram of Coil pack



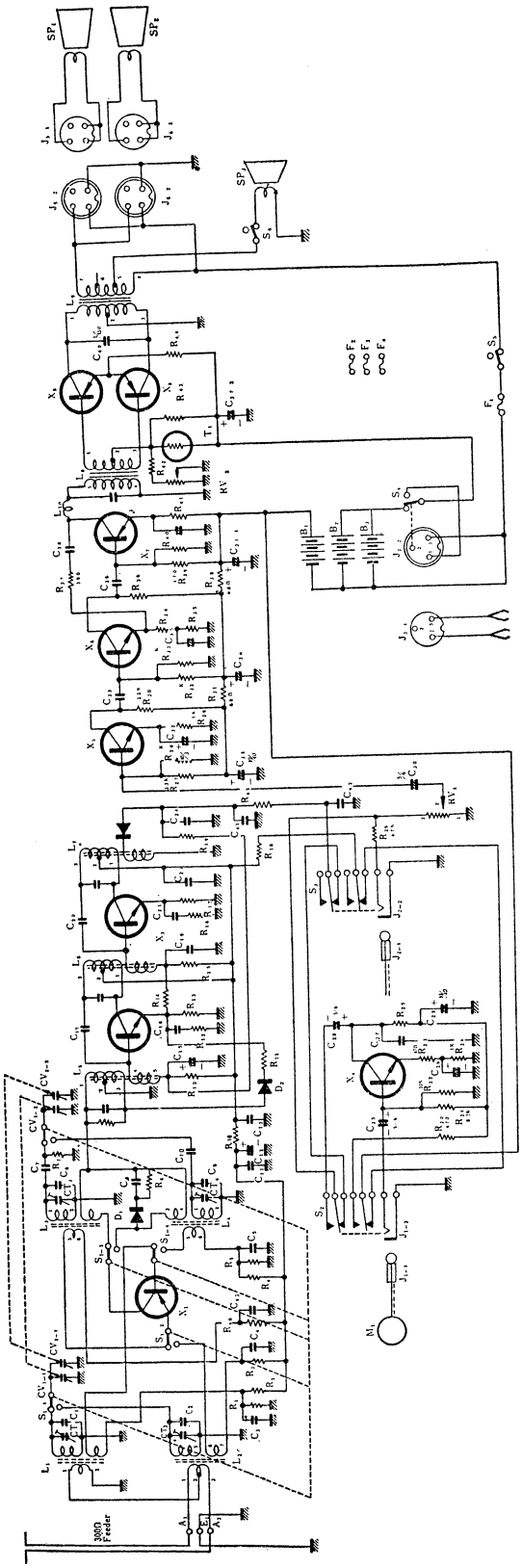
Wiring diagram

TR-903 Wiring diagram

Parts Symbol	Description
A_1	Terminal for doublet antenna
A_2	Terminal for doublet antenna
B_1	Battery size "D" 1.5 V×4
B_2	Battery size "D" 1.5 V×4
B_3	Battery size "D" 1.5 V×4
Capacitors	
C_1	Styrol 5 mmfd ±1 mmfd
C_2	Styrol 5 mmfd ±1 mmfd
C_3	Ceramic 0.01 mfd
C_4	Ceramic 0.002 mfd
C_5	Ceramic 0.01 mfd
C_6	Styrol 5 mmfd ±1 mmfd
C_7	Styrol 500 mmfd ±2%
C_8	Ceramic 0.001 mfd
C_9	Styrol 5 mmfd ±1 mmfd
C_{10}	Styrol 0.0025 mfd ±2%
C_{11}	Ceramic 0.01 mfd
C_{12}	Electrolytic 40 mfd 10 V
C_{13}	Ceramic 0.02 mfd
C_{14}	Ceramic 150 mmfd 10%
C_{15}	Electrolytic 30 mfd 6 V
C_{16}	Ceramic 0.04 mfd
C_{17}	Ceramic 2 mmfd ±0.5 mmfd
C_{18}	Ceramic 180 mmfd 10%
C_{19}	Ceramic 0.04 mfd
C_{20}	Ceramic 2 mmfd ±0.5 mmfd
C_{21}	Ceramic 0.01 mfd
C_{22}	Ceramic 180 mmfd 10%
C_{23}	Electrolytic 30 mfd 10 V
C_{24}	Ceramic 0.01 mfd
C_{25}	Electrolytic 5 mfd 6 V
C_{26}	Electrolytic 30 mfd 3 V
C_{27}	Ceramic 0.04 mfd
C_{28}	Electrolytic 5 mfd 6 V
C_{29}	Electrolytic 30 mfd 10 V
C_{30}	Electrolytic 5 mfd 6 V
C_{31}	Electrolytic 30 mfd 10 V
C_{32}	Electrolytic 30 mfd 3 V
C_{33}	Electrolytic 5 mfd 6 V
C_{34}	Electrolytic 30 mfd 10 V
C_{35}	Electrolytic 30 mfd 3 V
C_{36}	Electrolytic 30 mfd 6 V
C_{37-1}	Electrolytic (Block) 500 mfd 10 V
C_{37-2}	Electrolytic (Block) 1,000 mfd 10 V
C_{38}	Electrolytic 30 mfd 6 V
C_{39}	Electrolytic 100 mfd 10 V
C_{40}	MP 1 mfd 20% 150V
C_{41}	Ceramic 0.01 mfd +100% −0% 50 V
C_{42}	Ceramic 0.01 mfd +100% −0% 50 V
C_{43}	Ceramic 0.01 mfd +100% −0% 50 V
C_{44}	Polyester 0.01 mfd +100% −0% 50 V

Parts Symbol	Description
CT_1	Trimmer
CT_2	Trimmer
CT_3	Trimmer
CT_4	Trimmer
CV_{1-1}	Tuning Condenser
CV_{1-2}	Tuning Condenser
CV_{2-1}	Fine Tuning Condenser
CV_{2-2}	Fine Tuning Condenser
D_1	Diode 1T23
D_2	Diode 1T23
D_3	Diode 1T23
E_1	Ground Terminal
F_1	Fuse 1 A
F_2	Spare Fuse 1 A
F_3	Spare Fuse 1 A
F_4	Spare Fuse 1 A
J_{1-1}	Plug type "P"
J_{1-2}	Jack with DPDT Leaf Switch S_2
J_{2-1}	Plug type "P"
J_{2-2}	Jack with DPDT Leaf Switch S_3
J_{3-1}	Connector 3-pin female
J_{3-2}	Connector 3-pin male
J_{4-1}	Alligator Clip, Red
J_{4-2}	Alligator Clip, White
J_{5-1}	Connector 4-pin female
J_{5-2}	Connector 4-pin male
J_{6-1}	Connector 4-pin female
J_{6-2}	Connector pin male
L_1	MW Antenna Coil
L_2	SW Antenna Coil
L_3	MW Oscillator Coil
L_4	SW Oscillator Coil
L_5	IFT 1
L_6	IFT 2
L_7	IFT 3
L_8	Input Transformer
L_9	Output Transformer
L_{10}	RF choke
M_1	Microphone
R_1	RD 1/8 p 10k ohms 10%
R_2	RD 1/8 p 1.5k ohms 10%
R_3	RD 1/8 p 1k ohms 10%
R_4	RD 1/8 p 1.5k ohms 10%
R_5	RD 1/8 p 8.2k ohms 10%
R_6	RD 1/8 p 2.2k ohms 10%
R_7	RD 1/8 p 150k ohms 10%
R_8	RD 1/8 p 68 ohms 10%
R_9	RD 1/8 p 100k ohms 10%
R_{10}	RD 1/8 p 68k ohms 10%
R_{11}	RD 1/8 p 470 ohms 10%
R_{12}	RD 1/8 p 47 ohms 10%
R_{13}	RD 1/8 p 470 ohms 10%
R_{14}	RD 1/8 p 3.3k ohms 10%
R_{15}	RD 1/8 p 33k ohms 10%

Parts Symbol	Description
R_{16}	RD 1/8 p 47 ohms 10%
R_{17}	RD 1/8 p 470 ohms 10%
R_{18}	RD 1/8 p 100 ohms 10%
R_{19}	RD 1/8 p 5.6k ohms 10%
R_{20}	RD 1/8 p 470 ohms 10%
R_{21}	RD 1/8 p 82k ohms 10%
R_{22}	RD 1/8 p 10k ohms 10%
R_{23}	RD 1/8 p 47 ohms 10%
R_{24}	RD 1/8 p 1k ohms 10%
R_{25}	RD 1/8 p 2.2k ohms 10%
R_{26}	RD 1/8 p 4.7k ohms 10%
R_{27}	RD 1/8 p 33k ohms 10%
R_{28}	RD 1/8 p 5.6k ohms 10%
R_{29}	RD 1/8 p 1.2k ohms 10%
R_{30}	RD 1/8 p 2.2k ohms 10%
R_{31}	RD 1/8 p 68 ohms 10%
R_{32}	RD 1/8 p 47k ohms 10%
R_{33}	RD 1/8 p 5.6k ohms 10%
R_{34}	RD 1/8 p 22k ohms 10%
R_{35}	RD 1/8 p 330 ohms 10%
R_{36}	RD 1/8 p 1.2k ohms 10%
R_{37}	RD 1/8 p 390 ohms 10%
R_{38}	RD 1/8 p 68 ohms 10%
R_{39}	RD 1/8 p 470 ohms 10%
R_{40}	RD 1/8 p 2.4k ohms 10%
R_{41}	RD 1/8 p 10 ohms 10%
R_{42}	RD 1/8 p 120 ohms 10%
R_{43}	RD 1/8 p 15 ohms 10%
R_{44}	Wire-Wound 0.5 ohms ±5%
R_{45}	RD 1/8 p 2.2k ohms ±10%
R_{46}	RD 1/8 p 1k ohms ±10%
RV_1	Potentiometer 5k ohms A
RV_2	Potentiometer 500 ohms B
S_1	Band Set Switch
S_4	Micro Switch SPDT
S_5	Power on/off Switch SPST
S_6	Monitor speaker Switch SPST
SP_3	2.5" PM speaker
SP_2	12" Horn Speaker
SP_1	12" Horn Speaker
T_1	Thermistor
X_1	Transistor 2T201
X_2	Transistor 2T76
X_3	Transistor 2T76
X_4	Transistor 2T64
X_5	Transistor 2T65
X_6	Transistor 2T65
X_7	Transistor 2T303
X_8	Transistor 2T304
X_9	Transistor 2T304



TR-903 Circuit schematic diagram

QUICK GUIDE TO SIMPLE SERVICING

The transistor is a current device. Therefore, basical procedure of analysis of its operation is checking current. In any case, Mili-ammeter connected in series with power source battery will be quite helpful for trouble shooting.

The current for each transistor can be known by calculation from voltage drop across emitter resistor except in case of output stage whose emitter resistor scarcely has sufficient value to produce discernible voltage drop, in general.

Collector current can be considered actually equal to emitter current as base current is extremely small.

Required instruments

(1) Multi-meter
(2) Mili-ammeters 100 mA and 1 A
(3) Signal injector
(4) Signal generator
(5) Tools
  a. Screw driver
  b. Tweezers
  c. Wire cutter
  d. Soldering iron less than 30 Watts

In addition to the mentioned above, VTVM is recommended if available for convenience of Local oscillator voltage adjustment.

No Sound due to troubles after detector stage

No battery current	(1) Worn out battery All measurement or checking must be performed on specified battery voltage. (2) Poor battery contact (3) Defective power switch (4) Improper soldering on switch terminal (5) Open circuit in power supplying line
Heavy current	(1) Short circuit in power supplying line (2) Grounded power switch (3) Short circuit of condenser $C_{37\text{-}1}$ or $C_{37\text{-}2}$ (4) Grounded primary coil of Interstage transformer L_8 (5) Open circuited thermistor Th. (6) Grounded power supplying line
Excessive current	(1) Defective output transistor Larger Ico* (2) Short circuit between layers of Interstage or Output transformer Sometimes Oscillator coil or IF transformer may be included.
Mili-ammeter inserted in battery circuit deflects when Tuning condenser is turned with Volume control set at maximum.	(1) Open circuit or short circuit in secondary winding side Be careful especially of External speaker cable. (2) Open circuit in Speaker coil
No voltage on collector lead of driver or output transistors	(1) Open circuit in primary winding of audio transformer No voltage on output transistor collector means trouble in Output transformer. No voltage on driver transistor collector means trouble in Interstage transformer. (2) Open circuit of resistors in power supplying line.

Sound is heard when signal is injected to collector of driver but no sound in case of base.	(1) Defective driver transistor
Abnormal emitter voltage of driver	(1) Trouble in biasing circuit Check base voltage or bias resistor. (2) Defective transistor If the base voltage and bias resistor show normal value, faulty driver transistor may be suspected.

No sound due to troubles before detector stage

No sound is heard when signal is injected to primary winding of IF_3 but audio stages are working normally.	(1) Defective diode Normally the resistance of the diode is lower than 300 Ω in forward direction and higher than 50 kΩ in backward direction when measured by VO meter set at RX_{10} range. (2) Open circuit or short circuit between layers in secondary winding of IFT_3. (3) Defective by-pass condenser C_{24}

No sound due to troubles before detector stage

No voltage on collector of oscillator or IF transistor	(1) Open circuit in Oscillator transformer or primary winding of IF transformer (2) Open resistor in power supplying line, R_{18} or R_3
Abnormal emitter voltage of X_2 or X_3	(1) Check base voltage and biasing resistors (2) Defective transistor If the bias voltage and biasing resistors show normal value, transistor may be suspected.
No sound is heard when signal is injected to base of X_2 or X_3	(1) Defective X_2 or X_3 It must be kept in mind that X_3 is affected by X_2 as they are coupled directly. (2) Defective resonating condenser C_{18} or C_{22}

No sound due to troubles in converter stage

No sound is heard when signal is injected to base of X_1.	(1) Defective X_1
No voltage on X_1 collector	(1) Open circuit in primary winding of Oscillator transformer
Abnormal voltage or current in X_1	(1) Open resistor or varied value of resistors
Abnormal emitter voltage of X_1	(1) Defective emitter resistor (2) Defective emitter by-pass condenser C_{43} or C_{46}
No voltage on base of X_1	(1) Open circuit in Antenna coil L_1 (in case of medium wave) (2) Open circuit in Oscillator transformer L_4 (in case of short wave)
Noise increases by touching base or collector of X_1, with finger, or Remarkable click is heard from the speaker when emitter of X_1 is touched by test lead, Sometimes station is received faintly but not selectable.	(1) Defective condenser in emitter circuit (2) Short circuit between layers of secondary winding of Oscillator tranformer (3) Short circuit of Tuning condenser (4) Open circuit in primary winding of Antenna coil Station is received when antenna side of Tuning condenser is touched with metalic material (like screw driver).

Intermittently no sound or low output

In most cases, the sound is interrupted or comes out by giving mechanical shock.	(1) Conductor on the printed circuit board is going to break. (2) Poor contact of switches (3) Poor contact of battery (4) Incomplete conduction of resistor or improper soldering of component